ABSTRACT

The side tracking system includes a window mill having a full diameter cutting surface and a reduced diameter tapered cutting surface and a whipstock having a ramp engaging the reduced diameter cutting surface. The materials of the whipstock have a first cutablity and the materials of the casing have a second cutability. The reduced diameter cutting surface contacts the whipstock ramp at a first contact area and the full diameter cutting surface contacts the wall of the casing at a second contact area. As weight is applied to the mill, there is a first contact stress at the first contact area and a second contact stress at the second contact area. A cutability ratio is the first cutability divided by the second cutability and a contact stress ratio is the first contact stress divided by the second contact stress. The mill cuts the casing rather than the whipstock by maintaining the product of the cutability ratio and the contact stress ratio less than one. Preferably the height of the reduced diameter cutting surface is greater than the height of the full diameter cutting surface. The ramp includes a plurality of surfaces having different angles whereby the rate of deflection of the mill by the whipstock varies as the mill is lowered into the borehole. In particular, the ramp of the whipstock includes two surfaces having steep angles, one steep angled surface causing the mill to punch through the wall of the casing and the second steep angle surface moving the center of the mill across the wall of the casing.